coast of North America, and suggest that the islands off the coast north of Vancouver to Alaska may hide these and other breeding forms.

As this paper deals only with Petrels we may perhaps be allowed to add a note of interest foreign to the preceding. We would like to point out that the names proposed by us are arbitrary combinations of letters without any meaning whatever, unless we definitely give such. We consider it often impossible to guess the meaning of a word, and we would here cite the curious case of *Daption*. Stephens gave this name to a genus of Petrels and many workers have studied Greek dictionaries, attempting to extort a meaning. *Daptrion*, *Daptium* and *Daptes* have been suggested, the last mentioned now appearing as the meaning in the recent B. O. U. List of British Birds. It has recently occurred to us that *Daption* is simply an anagram or metathesis of *Pintado*, a seamen's name for the bird, and that our predecessors' labours for a derivation from the Greek have been in vain.

XXVIII. — *Studies on the Charadriiformes.* — I. *On the Systematic Position of the Ruff* (Machetes pugnax) *and the Semipalmated Sandpiper* (Ereunetes pusillus), *together with a Review of some Osteological characters which differentiate the Eroliinæ* (*Dunlin group*) *from the Tringinæ* (*Redshank group*). By Percy R. Lowe, M.B., M.B.O.U.

(Text-figures 10 & 11.)

In the British Museum Catalogue of Birds (vol. xxiv.); in the British Museum Hand-list of Birds; in Seebohm's 'Geographical Distribution of the Charadriidæ'; in the recent 'B.O.U. List of British Birds,' 1915, and in fact, so far as I am aware, in every systematic treatise or book in which a distinction is made between the subfamilies Tringinæ (Totaninæ *olim*) and Eroliinæ (Tringinæ *olim*), the Ruff is included in the subfamily Tringinæ or the Redshank group of Waders, as opposed to the Eroliinæ or the Dunlin association.

In some works, such as the A. O. U. Check-List of North American Birds, no distinction is drawn between these two

subfamilies, and the Ruff is included under the Scolopacinæ; in other works it is still more comprehensively sheltered under the wide-spreading wings of the Charadriidæ; while in the 'British Bird Book' one notes that the species which make up the Redshank subfamily are grouped indifferently along with the Dunlin association under a division which purports to be the subfamily Tringinæ.

It is not my intention to traverse the reasons which have led to this somewhat astonishing treatment of a bird which has been familiar to ornithologists for centuries, the object of this note being simply to demonstrate that there seems to be no possible sort of question whatever that the Ruff is not a Tringine form, that it is a somewhat specialised Dunlin, and that its proper systematic position is with the Dunlin association or the Eroliinæ.

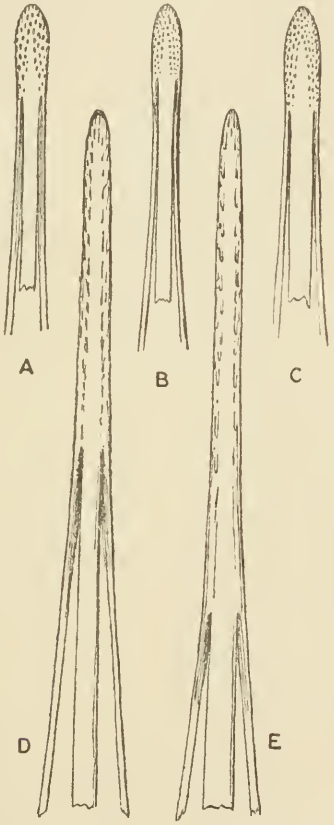
So far as this note is concerned, the proof of this will rest solely on osteological grounds; but it may be pointed out that in a paper by the author which recently appeared in 'The Ibis' (April 1915, p. 339) on "Coloration as a factor in Family and Generic Differentiation," it was pointed out that the colour-pattern characteristic of the downy nestling of the Ruff, as well as of immature and female examples, was undoubtedly Eroliine in type. I refer to this here, as being a distinct point to the good in favour of colour-pattern as a guide or clue to subfamily or generic affinities, borne out as it is, in this instance, in the most complete and definite way, by an appeal to osteological characters.

In any attempt to decide upon osteological grounds as to which of the aforementioned subfamilies the Ruff ought to be referred, it is obviously necessary to have gained some clear and definite knowledge as to the osteological features which characterise these two subfamilies.

So far as I am aware, these characters have never yet been set forth. I have lately been through all the available material in the British Museum and in the Royal College of Surgeons bearing on this question, and although, unfortunately, it is not so complete as one could have desired, it

seems amply sufficient for my immediate purpose. In the following lines, therefore, I propose to make a comparative examination of the osteological features characteristic of the two subfamilies, at the same time pointing out in what particulars the Ruff agrees or disagrees with either one

Text-figure 10.



Anterior portion of the skull from above showing the structure of the premaxillæ in:—A. *Ereunetes pusillus*; B. *Erolia alpina*; C. *Machetes pugnax*; D. *Tringa calidris*; E. *Tringa nebularia*.

or the other. Owing to want of space this comparative examination will be limited to the skull.

(1) *Premaxillæ.*—In the Eroliinæ, in the properly macerated skeleton, the distal end of the premaxillæ is seen to be

flattened and slightly spatulate. In a vertical section it would be found to be thin, so that this part of the bill bends easily upwards or downwards when pressure is applied. The foveated or "pitted" region at the anterior end of the premaxillæ is very restricted and has a bifid appearance (*cf.* text-fig. 10 A, B, C). When examined under a magnifying glass these "foveæ" are seen to be either circular or oval cell-like structures. They have a honeycomb-like appearance and they are sculptured *in relief* on the surface of the premaxillæ. In the Scolopacinæ these sculptured honeycomb-like cells are reproduced in a much more perfect and specialised form, and they also occupy a more extensive surface of the premaxillæ.

In the Tringinæ (Redshank group) the distal ends of the premaxillæ are more elongate or pointed. They are stiffer and less elastic, deeper in vertical section, and the circular "foveæ" so characteristic of the Eroliinæ are replaced by slit-like or elongate depressions. In the Tringinæ the foveated extremity occupies a much longer space both actually and relatively (*cf.* text-fig. 10 D, E).

In respect of these characters the Ruff is undoubtedly Eroliine (*cf.* text-fig. 10 C).

(2) In both the Eroliinæ and the Tringinæ the maxillary process of the premaxilla originates on either side as a free-running bar immediately caudad of the posterior limits of the foveated region of that bone; but corresponding to the restricted area of the foveated region in the Eroliinæ the maxillary process has a free and independent existence at a point very conspicuously nearer to the anterior end of the bill than is the case with the Tringinæ (*cf.* text-fig. 10).

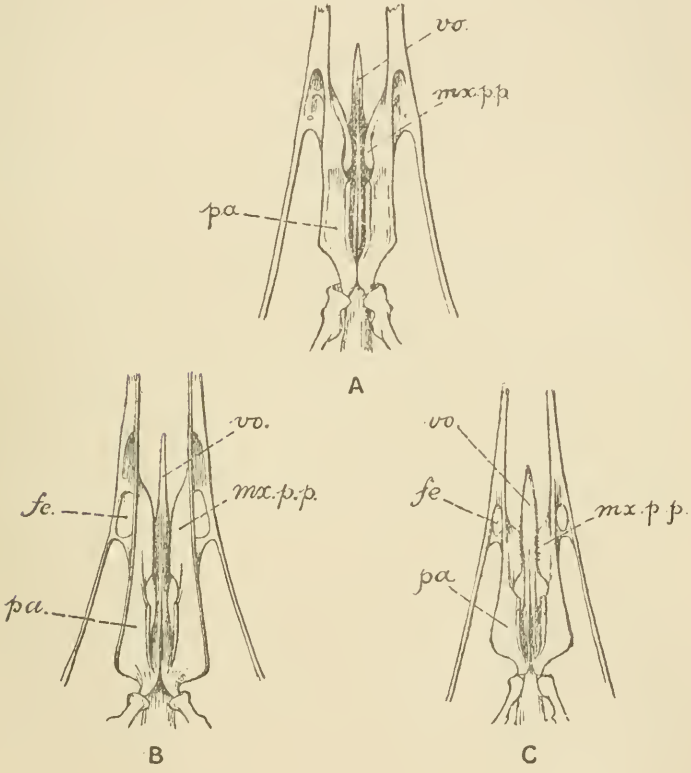
In respect of these characters the Ruff is undoubtedly Eroliine.

(3) *The Palatines.*—In the Eroliinæ the external and posterior margins of the palatal plates form at their junction almost a right angle, the actual angle being somewhat rounded off (*cf.* text-fig. 11 B). In the Tringinæ this postero-external angle of the palatal plate is obtuse (*cf.* text-fig. 11 A). In the Eroliinæ the pterygoid processes of the palatal plates are short, thick, and conspicuously divergent.

In the Tringinæ they are long and ribbon-shaped, and towards the pterygoid articulation tend to be more parallel.

In the Eroliinæ the palatal plates are wider posteriorly than anteriorly. In the Tringinæ the external and internal

Text-figure 11.



Palatal structure of the skulls of:—A. *Tringa nebularia* ; B. *Erolia alpina* ; C. *Machetes pugnax*. *fe.* = fenestration of the maxillary plate ; *mx.p.p.* = maxillo-palatine process ; *pa.* = palatines ; *vo.* = vomer.

borders are parallel. In the Eroliinæ the palatal groove is shallower than in the Tringinæ, the inner and outer lamina of the latter being deeper and projecting downwards in a more conspicuous manner. By a reference to the figures

shown, the palatal plates of the Ruff will be seen to be in respect of all these characters obviously Eroliine.

(4) *The Maxillo-palatine process* in the Eroliinæ is seen to have completely fused with the pre-palatal portion of the palatal plate of either side as a thin elongate plate with parallel internal borders devoid of sculpturing.

In the Tringinæ the maxillo-palatine process is observed to extend backwards on either side of the vomer as a very attenuated pear-shaped or sac-like process, which is free throughout the greater part of its course.

In the Ruff the maxillo-palatine process is slightly specialised and, curiously enough, its inner margin is slightly crenated, but, as will be evident from the figure, it is undoubtedly Eroliine rather than Tringine.

(5) In the Eroliinæ the inwardly-projecting plate of the maxillary is fenestrated (*cf.* text-fig. 11 B, *fe.*) as it is in the Ruff. In the Tringinæ this fenestration is conspicuous by its absence, although there are indications of it.

The above characters would appear to be sufficient not only to differentiate between the Eroliinæ and the Tringinæ, constant as such characters are in all the genera and species of either subfamily which I have examined (*cf.* list below), but also to demonstrate the fact that there is no longer any possible excuse for grouping the Ruff with the Tringinæ.

There are, however, other characters serving to distinguish the Eroliinæ from the Tringinæ, and incidentally to clear up the misconception as to the position of the Ruff. These, owing to want of space, we can only refer to very briefly. They are as follows:—

(6) In the Eroliinæ the line of the culmen of the bill makes an obtuse angle (roughly 140°) with the basi-sphenoidal rostrum. In the Tringinæ the angle made by these two lines is much more obtuse or nearly non-existent. It thus comes about that in the Eroliinæ the line of the culmen forms a slope which is all but identical and continuous with the slope of the line representing the inter-orbital depression. In the Tringinæ the slope of this

gradually ascending line is rather abruptly interrupted by the much sharper slope of the nasal region.

In respect of this feature the Ruff agrees with the Eroliinæ.

(7) In the Eroliinæ the zygomatic arch or quadrato-jugal rod makes a very distinct angle with the maxillary process of the premaxillæ. In the Tringinæ this angle is hardly observable. In the Eroliinæ the zygomatic rod is relatively as well as actually shorter than in the Tringinæ, and it makes an obtuse angle with the outer process of the nasal. In the Tringinæ this angle is acute. These characters, so far as I have been able to observe with the material to hand, are constant and conspicuous.

In respect of them, however, it is to be noted that the Ruff is more Tringine than Eroliine.

In both the Eroliinæ and the Ruff the outer or descending processes of the nasal bones are very slender and round. In the Tringinæ they are ribbon-shaped or flattened.

(8) The lacrymals, especially as regards their descending processes, differ in the two subfamilies. Want of space forbids a detailed description, but the characters exhibited serve as useful distinguishing factors. The lacrymals of the Ruff are slightly specialised, but agree in their main features with the Eroliinæ, especially as regards the Knot (*Canutus canutus*).

(9) The antorbital plates are differentiated in the two subfamilies, a wider space being apparent in the Tringinæ between their upper margins and the lower surfaces of the lacrymals. In *Heteropygia* this plate practically fuses with the lacrymal.

(10) In the Tringinæ the grooves for the supra-orbital glands in the interorbital space are marginal and quite conspicuous. In the Eroliinæ they are very difficult to make out.

In respect of these alternate characters the Ruff agrees with the Tringinæ.

(11) In the Eroliinæ the post-articular process of the mandible is directed upwards in an abruptly hook-shaped fashion.

In respect of this character the Ruff agrees with the Eroliinæ.

(12) In the Tringinæ, the supra-occipital region, when the skull is viewed from above, forms a somewhat conspicuous and conical projection backwards. In the Eroliinæ the outline of the skull in this region when viewed from above forms an arc of an almost perfect circle. This distinguishing character is a useful and constant one.

Finally, it may be shortly stated that in regard to the systematic position of the Semipalmated Sandpiper (*Ereunetes pusillus*), everything that has been written above bearing on the proper position of the Ruff applies to this form, except that there are no such Tringine deviations such as are given as applying to the Ruff under paragraphs (7) and (10).

It is a most remarkable fact that all the authorities quoted in the opening paragraph of this article include *Ereunetes* with the Tringinæ, whereas it is without question a typical Eroliine form.

Tested by the osteological characters given above, there seems to be no room for doubt that the following forms, whose skulls and other skeletal features I have been able to examine, must be included in the subfamily Eroliinæ:—

Erolia alpina alpina; *Erolia minuta*; *Arquatella maritima*; *Ereunetes* * (? *Erolia*) *pusillus*; *Ancylochilus subarquatus*; *Calidris arenaria*; *Heteropygia maculata*; *Micropalama himantopus*; *Canutus canutus*; *Eurynorhynchus pygmæus*; and *Machetes pugnax*.

On the other hand, so far as the material which I have at present been able to examine is concerned, the following forms must be included in the subfamily Tringinæ:—

Tringa ochropus; *Tringa solitaria*; *Tringoides hypoleucos*; *Tringoides macularius*; *Rhyacophilus glareola*; *Tringa calidris*; *T. flavipes*; *T. nebularia*; and *T. stagnatilis*.

* I can discover no osteological features either in the skull or elsewhere which would seem to justify the creation of a separate genus (*Ereunetes*) for this form.